

Appl. No. 10/634,585  
Amdt. Dated December 9, 2005  
Response to Office Action Dated October 28, 2005

### AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

#### **Listing of Claims**

1. - 9. (Cancelled)
10. (Previously Presented) A logging tool comprising:
  - a tool body configured for use in a borehole;
  - a receiving antenna disposed on the tool body; and
  - a transmitting antenna disposed on the tool body at a spaced apart location from the receiving antenna; and
  - an antenna tuning circuit comprising a relay having a coil, the coil coupled to a signal line that carries ~~signals~~ a signal applied to the transmitting antenna, wherein a control signal for the antenna tuning circuit and the signal applied to the transmitting antenna both propagate along the signal line, and wherein the antenna tuning circuit is selectively tunable to obtain a plurality of resonant frequencies.
11. (Previously Presented) The logging tool as defined in claim 10 wherein the antenna tuning circuit selectively couples capacitance to the transmitting antenna to obtain the plurality of resonant frequencies.
12. (Previously Presented) A logging tool comprising:
  - a tool body configured for use in a borehole;
  - a receiving antenna disposed on the tool body;
  - a transmitting antenna disposed on the tool body at a spaced apart location from the receiving antenna, wherein the transmitting antenna is selectively operable at three or more resonant frequencies for transmitting electromagnetic radiation;
  - an antenna tuning circuit coupled to the transmitting antenna, the antenna tuning circuit operable to selectively couple capacitance to the transmitting antenna to obtain the three or more resonant frequencies, the antenna tuning circuit further comprising:

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a relay having a coil, the coil coupled to a signal line that carries signals to the transmitting antenna;  
said relay having a set of contacts selectively coupled by activation of the coil; and  
wherein in a first contact position a capacitance is coupled to the transmitting antenna, and  
wherein in second contact position the capacitance is not coupled to the transmitting antenna.

13. (Original) The logging tool as defined in claim 12 wherein the relay couples within a junction box proximate to the transmitting antenna.

14. (Previously Presented) The logging tool as defined in claim 10 wherein the antenna tuning circuit selectively couples windings of the transmitting antenna to obtain the three of more resonant frequencies.

15. (Previously Presented) A logging tool comprising:  
a tool body configured for use in a borehole;  
a receiving antenna disposed on the tool body; and  
a transmitting antenna disposed on the tool body at a spaced apart location from the receiving antenna, wherein the transmitting antenna is selectively operable at three or more resonant frequencies for transmitting electromagnetic radiation;  
an antenna tuning circuit coupled to the transmitting antenna, the antenna tuning circuit operable to selectively couple windings of the transmitting antenna to obtain the three of more resonant frequencies, the antenna tuning circuit further comprising:  
a relay having a coil, the coil coupled to a signal line that carries signals to the transmitting antenna;  
said relay having a set of contacts selectively coupled by activation of the coil; and

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wherein in a first contact position a first set of windings of the transmitting antenna is coupled in parallel with a second set of windings of the transmitting antenna, and

wherein in second contact position the first set of windings of the transmitting antenna is coupled in series with the second set of windings of the transmitting antenna.

16. (Original) The logging tool as defined in claim 15 wherein the relay couples within a junction box proximate to the transmitting antenna.
17. (Original) The logging tool as defined in claim 10 further comprising:
  - a plurality of receiving antennas disposed in the tool body;
  - a plurality of transmitting antennas disposed on the tool body; and
  - wherein at least one of the plurality of transmitting antennas is selectively operable at three or more resonant frequencies.
18. (Original) The logging tool as defined in claim 17 further comprising:
  - three receiving antennas disposed on a medial portion of the tool body;
  - three transmitting antennas disposed on a first end of the tool body; and
  - three transmitting antennas disposed on a second end of the tool body.
19. (Original) The logging tool as defined in claim 18 wherein the tool body further comprises a tool body adapted for use within a drillstring.
20. (Currently Amended) A bottom hole assembly comprising:
  - a drill bit;
  - a logging tool coupled to the drill bit, the logging tool comprising:
    - a tool body;
    - a plurality of receiving antennas disposed on the tool body; and

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a plurality of transmitting antennas disposed on the tool body at a spaced apart location from each other and the receiving antennas;  
an antenna tuning circuit comprising a relay having a coil, the coil coupled to and configured to receive a control signal from a signal line that carries signals to a first transmitting antenna, wherein the antenna tuning circuit is selectively tunable to obtain a plurality of resonant frequencies.

21. (Previously Presented) The logging tool as defined in claim 20 further comprising a plurality of antenna tuning circuits coupled one each to the plurality of transmitting antennas, each antenna tuning circuit each selectively couples capacitance to its respective transmitting antenna to achieve a plurality of resonant frequencies.

22. (Previously Presented) A bottom hole assembly comprising:  
a drill bit;  
a logging tool coupled to the drill bit, the logging tool comprising:  
a tool body;  
a plurality of receiving antennas disposed on the tool body; and  
a plurality of transmitting antennas disposed on the tool body at a spaced apart location from each other and the receiving antennas;  
wherein each transmitting antenna is selectively operable at greater than two resonant frequencies for transmitting electromagnetic radiation;  
a plurality of antenna tuning circuits coupled one each to the plurality of transmitting antennas, each antenna tuning circuit each selectively couples capacitance to its respective transmitting antenna to achieve the greater than two resonant frequencies, wherein each antenna tuning circuit further comprises:  
a relay having a coil, the coil coupled to a signal line that carries signals to a transmitting antenna;  
said relay having a set of contacts selectively coupled by activation of the coil; and

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wherein in a first contact position a capacitance is coupled to the transmitting antenna, and  
wherein in second contact position the capacitance is not coupled to the transmitting antenna.

23. (Original) The logging tool as defined in claim 22 wherein the relay couples within a junction box proximate to its respective transmitting antenna.

24. (Previously Presented) The logging tool as defined in claim 20 further comprising a plurality of antenna tuning circuits coupled one each to the transmitting antennas, each antenna tuning circuit operable to selectively couple windings of a transmitting antenna to achieve the plurality of resonant frequencies.

25. (Previously Presented) A bottom hole assembly comprising:  
a drill bit;  
a logging tool coupled to the drill bit, the logging tool comprising:  
a tool body;  
a plurality of receiving antennas disposed on the tool body; and  
a plurality of transmitting antennas disposed on the tool body at a spaced apart location from each other and the receiving antennas, wherein each transmitting antenna is selectively operable at greater than two resonant frequencies for transmitting electromagnetic radiation;  
a plurality of antenna tuning circuits coupled one each to the transmitting antennas, each antenna tuning circuit operable to selectively couple windings of a transmitting antenna to achieve the greater than two resonant frequencies, wherein each antenna tuning circuit further comprises:  
a relay having a coil, the coil coupled to a signal line that carries signals to a transmitting antenna;  
said relay having a set of contacts selectively coupled by activation of the coil; and

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wherein in a first contact position a first set of windings of the transmitting antenna is coupled in parallel with a second set of windings of the transmitting antenna, and  
wherein in second contact position the first set of windings of the transmitting antenna is coupled in series with the second set of windings of the transmitting antenna.

26. (Original) The logging tool as defined in claim 25 wherein the relay couples within a junction box proximate to its respective transmitting antenna.

27.-41. (Cancelled)